

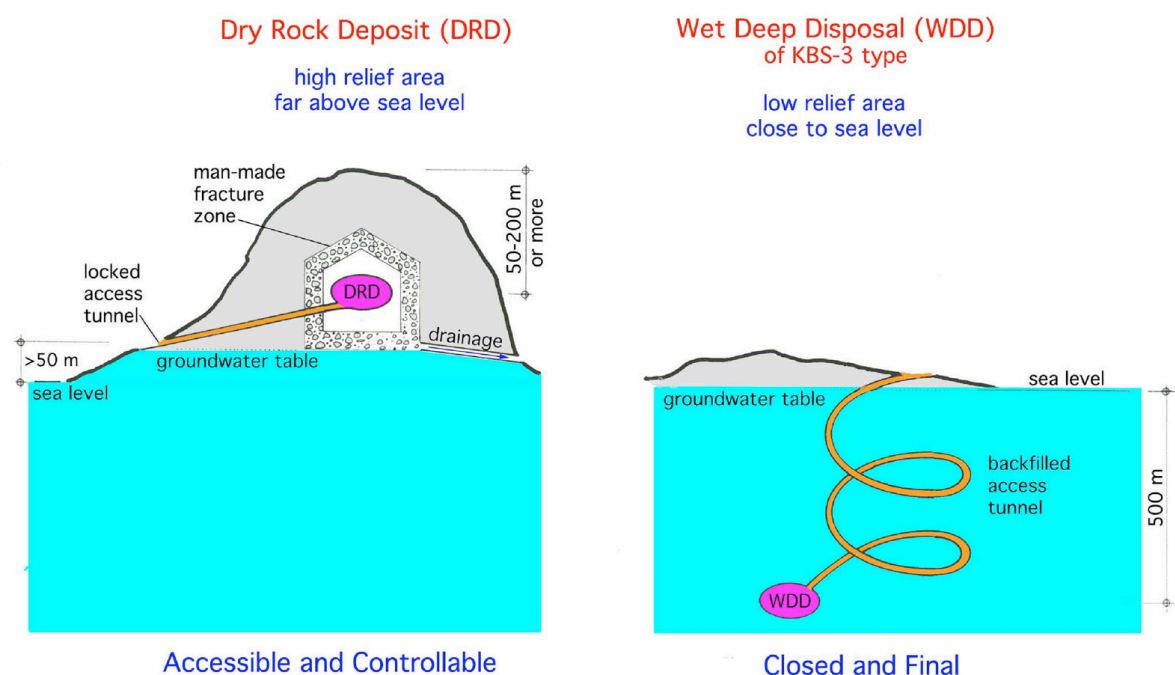
***To Members of the Blue Ribbon Commission  
and its Subcommittee on Nuclear Waste Storage and Disposal***

You are visiting Finland and Sweden and will surely hear how good and safe the KBS-3 method is. Well, we have a different view founded on 30 years of painstaking research in geology and paleogeophysics. Our investigations were performed at Paleogeophysics & Geodynamics at Stockholm University, which I headed. Numerous peer-reviewed papers have been published. Three Ph.D.-theses on just these subject have passed. Numerous international top-specialists have joined our group. Major international excursions have been run in 1999 and in 2008 (as a part of the 33rd IGC). Most of our findings have been presented in my book of 2003 on "Paleoseismicity on Sweden - a novel paradigm" (320 pp, hard cover, colour). A copy should have been presented to you in Stockholm.

We have, conclusively I would say, shown that Sweden and Finland, at the time of deglaciation and rapid land uplift, was a high-seismic area in frequency and magnitude. In total we have described 59 paleoseismic events (based on multiple criteria: fault and fractures, sediment deformation and liquefaction (over large areas), deposition of extensive turbidites, the relation to tsunami events (17 recorded) and the dating by varves as to a single year). Bedrock fracturing and faulting have been recorded over vast areas at single earthquakes; viz. 50x50 km at the 9663 BP event and 50x100 km at the 10,430 BP event. Finally, we have recorded extensive bedrock tectonics as a function of explosive venting of methane gas at the phase transition from methane ice to methane gas (the last one occurred as late as 2000 BP and set up a 20 m high tsunami wave).

Our findings (the high magnitude and numbers of earthquakes and the new finding of methane venting tectonics) violate a long-term safety of a KBS-3 type repository, which has to stay intact for "at least 100,000 years". The large areas of bedrock deformation at single earthquake events violate the so-called respect-distance (only 50-100 m) used by SKB and Posiva between canisters and regional fault zones.

In this situation we have proposed another way of handling the high-level waste, viz. the deposition in a Dry Rock Deposit; i.e. the DRD-method. In such a repository the waste remains accessible and controllable for the good (use and re-cycling) and the bad (repair).



## Dry Rock Deposit argued in favour of Wet Deep Disposal

Björn Cronhjort & Nils-Axel Mörner

### *Radwaste Solutions*

May/June, 2004

#### Comparison between alternative methods of disposal of high level nuclear waste in the bedrock

DRD – dry rock deposit according to our model

DOE – dry bedrock deposition in Yucca Mountain, USA

WDD – wet bedrock deposition according to the KBS-3 model

	<b>DRD</b>	<b>DOE</b>	<b>WDD</b>
<b>Environment</b>	<b>dry</b>	<b>dry</b>	<b>wet</b>
<b>Depth (m)</b>	<b>50-200</b>	<b>300</b>	<b>500</b>
<b>Country</b>	<b>(SE)+</b>	<b>USA</b>	<b>SE-SF</b>
<b>Accessibilty</b>	<b>yes</b>	<b>yes</b>	<b>no</b>
<b>Monitoring</b>	<b>yes</b>	<b>yes</b>	<b>no</b>
<b>Retrievability</b>	<b>yes</b>	<b>maybe</b>	<b>no</b>
<b>Transmutation</b>	<b>yes</b>	<b>maybe</b>	<b>no</b>
<b>Duration (yrs)</b>	<b>up to next Ice Age</b>	<b>up to 10,000</b>	<b>100,000 or more</b>

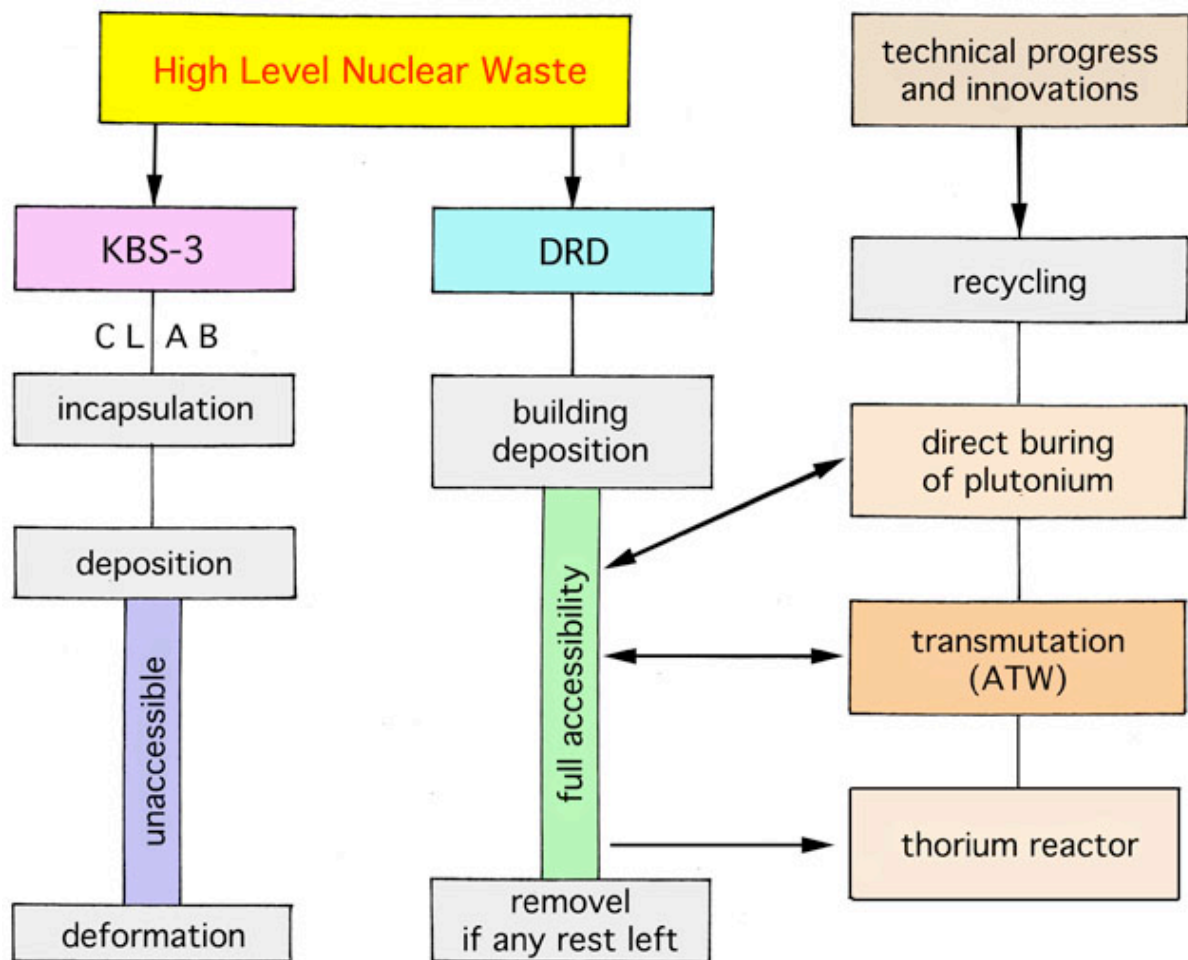
*From: Cronhjort & Mörner, 2004*

A DRD-repository can be constructed in many different ways, viz as a zero alternative, as an intermediate repository and also as a “final” repository (depending upon what one wants to achieve and the conditions of the location chosen; as discussed in *Detta Eviga Avfall*, 2009). The cost of a DRD-repository seems to be in the order of 1/4<sup>th</sup> to 1/3<sup>rd</sup> of a KBS-3 repository.

It seems quite strange to bury the waste in an inaccessible repository now when can foresee innovations and technological advances in the near future with respect the 4<sup>th</sup> generation of nuclear reactors, transmutation, the thorium reactor, etc.

This is illustrated in the figure on the next page (from Mörner, 2009) where the differences between a KBS-3 repository and a DRD-repository is highlighted including the application of technological innovations.

A DRD-repository concurs with modern scientific knowledge of processes and conditions in the bedrock, with environmental concern, with energy concern, with respect for technical improvements and innovations, and with respect to ethics and future concern.



From: Mörner, 2009 and FuD-reviews, 2008, 2009

With this short note I wanted to inform you about two facts of relevance for evaluation of the handling of high-level nuclear waste:

- (1) things are not at all as simple and straight forward as claimed by SKB and Posiva when it concerns earthquakes, respect distance and methane venting tectonics
- (2) there is an alternative method well worth considering

with all the best wishes  
Stockholm 2010-10-20

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